



Mobile Phone R520 Developers' Guidelines

Bluetooth™ Wireless Technology

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Bluetooth™ Wireless Technology

This document describes for application developers with regard to the high level radio procedures and user interface aspects of the Bluetooth function in the first mobile phones with a built-in Bluetooth module. (The purpose is not to specify in detail how other manufacturers should design headsets, PCs or printers that work together with Ericsson phones.

1 Introduction

1.1 Scope

This document describes the menu structure and primary use cases for the Bluetooth function in the R520 phone.

The reader is assumed to be familiar with the Bluetooth specification, especially volume 2 and the Generic Access Profile.

1.2 Performance

The Bluetooth function is based on a baseband module with the following characteristics:

- Supported data rate is 100 kbps
- DM1/DH1 packets are used to ensure reliable data transfer
- General inquiry is supported, limited inquiry is not
- Master/slave switch is not supported
- No power save modes (neither HOLD, PARK nor SNIFF) are supported
- Audio is supported over SCO links.

1.3 Profile Compliance

The phone is compliant with version 1.0B+erratas of the following Bluetooth profiles:

- Generic Access Profile
- Serial Port Profile
- Dial-up Networking Profile
- Fax Profile
- Headset Profile
- Generic Object Exchange Profile
- Object Push Profile
- Synchronisation Profile.

In addition, communication with printers is based on the Object Push Profile.

1.4 Accessories

The R520 phone is optimised for usage with its Bluetooth accessory HBH-10 (a headset) as well as for usage with PCs (with Bluetooth module built-in or on PC card).

The phone also supports phone to phone communication, e.g. business card exchange and interactive games.

1.5 Design Principles

Use of the phone with other Bluetooth devices should be application driven (no connect commands or device addresses to be entered, only implicit control from within application user interfaces). Connections are established only when user data is to be transferred.

The prime use of the phone is with paired devices (accessories) that know the phone, and are known to the phone, beforehand. Pairing can from the phone point of view be seen as “connecting the wireless cable”. Bluetooth passkeys are not used as “login during connect”.

For communication with un-known devices, device discovery is first performed. The user should never encounter a need to view or enter a Bluetooth Device Address (BD_ADDR). Alternatively, discoverable mode is explicitly entered for a temporary time. The phone is only discoverable for a limited time in order to minimise “radio pollution” but also to avoid occupying the Bluetooth resource due to “spamming”.

Regarding security aspects, the Bluetooth function in the phone is designed with the strategy that the phone has something to protect. Especially the following is regarded as important:

- Personal user data (e.g. PIM content);
- Network access mechanisms (e.g. the GSM radio and subscription);
- Power (no unnecessary radio transmissions should degrade standby and performance times);
- User interface (user should not be burdened with handling irrelevant events);
- The Bluetooth Device Address, BD_ADDR (if displayed, phone could encounter hostile connection attempts).

Therefore, the phone will enforce authentication of remote devices (unless in discoverable mode) and encryption of authenticated links. Also the time spent in discoverable mode is limited.

1.6 References

[GAP]	The Bluetooth Specification, part K:1, the Generic Access Profile
[HSP]	The Bluetooth Specification, part K:6, the Headset Profile
[SPP]	The Bluetooth Specification, part K:5, the Serial Port Profile
[DUN]	The Bluetooth Specification, part K:7, the Dial-up Networking Profile
[GXP]	The Bluetooth Specification, part K:10, the Generic Object Exchange Profile
[OPP]	The Bluetooth Specification, part K:11, the Object Push Profile
[SP]	The Bluetooth Specification, part K:13, the Synchronisation Profile
[R520]	R520 AT command on-line reference.

2 Function Overview

Under Extras/Bluetooth, the following menus are available:

- Discoverable
- Paired devices
- Discover
- Operation mode.

In addition to these, use of the Bluetooth function can be managed from:

- Settings/Phone name
- Extras/Synchronisation/Synchronise/Use Bluetooth
- Through Send via Bluetooth and Receive via Bluetooth options in the Phone book and Calendar.

2.1 Operational Modes

After selecting Extras/Bluetooth/Operation mode, the user can set the operational mode of the Bluetooth function in the phone. The phone supports 3 different operational modes:

- OFF
- Auto
- ON

When operational mode is set to OFF, the Bluetooth function in the phone is totally disabled. No emission in the ISM band generated from the Bluetooth function in the phone can occur.

When operational mode is set to Auto, applications in the phone can initiate discovery and connection establishment procedures but the phone is not discoverable or connectable. As default, the operational mode is set to Auto.

When operational mode is set to ON, the Bluetooth function in the phone is fully enabled for communication with its Bluetooth accessories (actually with all paired devices in general). When the phone gets paired to another Bluetooth device, the operational mode is automatically set to ON. When operational mode is set to ON, the phone will authenticate all devices when establishing a connection (except when the phone is temporarily made discoverable, see 2.2).

The operational modes are defined by different combinations of the connectable/non-connectable, discoverable/non-discoverable and security modes defined in [GAP]:

	Initiable	Connectable mode [GAP]	Discoverable mode [GAP]	Security mode [GAP]
OFF	No	No	No	No
Auto	Yes	No	No	No
On	Yes	Yes	No	Yes, 3

Initiable means that Bluetooth discovery or connection establishment procedures can be initiated from a phone application. Non-initiable means that they cannot. In order for the Bluetooth function to be used, the operational mode has first to be set to something else than OFF. To ensure that no kind of Bluetooth emission is generated in the phone, the user can select to set the operational mode to OFF.

NOTE: *Usage of the OFF mode must be seen as an exceptional case that users normally need not use. The Bluetooth function consumes no power when the operational mode is set to Auto.*

When in connectable mode, the Bluetooth function in the phone enters the page_scan state and responds to paging from other devices. In non-connectable mode it will not.

When in discoverable mode, the Bluetooth function in the phone enters the inquiry_scan state and responds to inquiries. In non-discoverable mode it will not.

Security mode 3 means the phone will initiate authentication on link level, i.e. before knowing what kind of channel/connection that is to be requested.

2.2 Discoverable

When Extras/Bluetooth/Discoverable is selected, the phone is temporarily enabled for communication with any other Bluetooth device (not just to paired devices). When Discoverable, the phone will not authenticate any device when establishing a connection. When Discoverable, the phone is in discoverable mode for 3 minutes before returning to the previous operational mode (ON or Auto).

When in discoverable mode, the phone can receive objects (e.g. business cards and appointments) from other devices. The phone will also accept pairing if initiated from another device. It will though not initiate authentication or pairing in case the remote device tries to access a restricted application without first initiating pairing.

Discoverable is defined by different combinations of the connectable/non-connectable, discoverable/non-discoverable and security modes defined in [GAP]:

	Initiable	Connectable mode [GAP]	Discoverable mode [GAP]	Security mode [GAP]
Discoverable	Yes	Yes	Yes	1

When in discoverable mode, the Bluetooth function in the phone enters the inquiry_scan state and responds to inquiries. In non-discoverable mode it will not.

Security mode 1 means no security is applied.

When in discoverable mode, the phone has the following Class of Device/Service bits set:

R520	Major device class = Phone Minor device class = Cellular Service class = Object Transfer Service class = Telephony Service class = Networking.
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2.3 Status Indications

The phone provides three different Bluetooth status indicators in the standby screen.

When the Bluetooth function is in the page_scan state (e.g. when the operational mode is set to ON and no communication is in progress), a "Bluetooth ON" icon is shown.

When the Bluetooth function is in the inquiry_scan state in addition to page_scan (e.g. when Discoverable and no communication is in progress), a "Discoverable" icon is shown.

When the Bluetooth function is in active communication (i.e. a connection is established), a “Bluetooth connection active” icon is shown.

The appearance of the icons is as follows:

Bluetooth ON	Discoverable	Bluetooth connection active
		

2.4 Pairing

NOTE: *Ericsson has provisionally decided not to use the recommended term ‘Bonding’ [GAP], but instead use the term ‘Pairing’.*

Under Extras/Bluetooth/Paired devices, the user finds a list of paired devices and an option to add new entries to the list.

Each entry in the list of paired devices consists of a personal name tag (default value is the Bluetooth Device Name retrieved from the paired device) and a device type indication. For each entry in the list of paired devices, the user can choose between the options to:

- Edit (change name tag to a personal value)
- Delete (de-pair, i.e. remove the stored link key)
- Edit order (position of entry in the list)
- Reset name tag (replace personal value with the default value).

It is possible to add new entries to the list of paired devices (i.e. to pair the phone with other Bluetooth devices). After choosing Add new, the user selects between:

- Phone initiates (i.e. the phone acts as initiator of the pairing procedure)
- Phone accepts (i.e. the phone is temporarily set into discoverable mode and pairable mode [GAP] and is ready for pairing to be initiated from another Bluetooth device).

When pairing is initiated (Extras/Bluetooth/Paired devices/Add new/Phone initiates), the user is asked to select if to discover all types of devices or just headsets or computers. After selecting one discovered device, user is asked to enter a Bluetooth passkey and then pairing proceeds. If successful, the user can then assign a personal name tag of the paired device to be seen in the list of paired devices.

When phone is set to accept pairing (Extras/Bluetooth/Paired devices/Add new/Phone accepts or Extras/Bluetooth/Discoverable), the phone indicates that is ready to pair. When a pairing request is received, the user is asked to confirm that he/she accepts to pair with the connected device. If accepted, user is asked to enter a Bluetooth passkey. Then pairing proceeds and if successful, the user can assign a personal name tag of the paired device to be seen in the list of paired devices.

The phone supports entering of passkeys consisting of decimal digits only. At least one digit, and up to 16, must be entered.

2.5 Discovery

The user can initiate the Bluetooth device discovery [GAP] procedure by selecting Extras/Bluetooth/Discover. All Bluetooth devices in range that are set into discoverable mode will now be discovered.

When the device discovery procedure is completed, the user is presented a list of Discovered devices. Each entry consists of a device type indication and device name (the Bluetooth Device Name retrieved from the devices that responds to the inquiry). The following device types can be distinguished:

Device type	Class of Device/Service bits set
Phone	Major device class = phone
Headset	Major device class = audio, Minor device class = headset
Homebase	Major device class = phone, Minor device class = fixed modem or voice gateway
PC	Major device class = computer

Device type	Class of Device/Service bits set
PDA/HPC	Major device class = computer, Minor device class = HPC/PDA or Palm/PDA
Printer	Service class = Object Transfer & Rendering

For each entry in the list of discovered devices the user can select between the options to:

- Send my own (same option as available in phone book)
- Add to paired devices (i.e. phone initiates pairing).

If the phone is to be discovered by another device that initiates Bluetooth device discovery, it has to be set into discoverable mode by selecting Discoverable.

2.6 Phone Name

After selecting Settings/Phone name/Edit it is possible for the user to set the Bluetooth Device Name (BDN) of the phone to a personal value. (The BDN is used when the phone responds to an LMP_name_request.)

The BDN is by default set to the phone model name.

In case the phone name is still set to the default name when the phone is made Discoverable, the user will be asked to change it. This in order to decrease the risk of having many phones in the same room responding to an inquiry with the same name.

2.7 Information Exchange

2.7.1 Sending objects

When having selected a calendar entry (under Extras/Calendar) or a personal ring melody (under Settings/Sounds & alerts/My melodies) the user can select the option Send.

A phone book entry can be transferred by selecting Phonebook/Business cards/Send contact and the users own business card can be transferred by selecting Phone book/Business cards/Send my own. The whole phone book can be transferred by selecting Phone book/Business cards/Send all and a whole calendar view can be transferred by selecting Calendar/Send.

After selecting Send, user normally selects transfer medium: Send via Ir or via Bluetooth. When via Bluetooth is selected, the phone starts a device discovery procedure in order to find the device which to send the selected object to. (Only devices with the Object Transfer bit set in the Class of device/Service field will be discovered). When the user selects the receiver in the list of discovered devices, the object is transferred.

2.7.2 Receiving objects

In order to be able to receive an object, the phone has to be enabled for reception. This is done by selecting Extras/Bluetooth/Discoverable or Phone book/Business cards/Receive contact or Extras/Calendar/Receive or the Receive option for a personal ring melody under Settings/Sounds & alerts/My melodies.

After selecting Receive, user selects medium: Receive via Ir or via Bluetooth. When via Bluetooth is selected, the phone is made Discoverable.

2.7.3 Object formats

Contacts are transferred in vCard format. Calendar entries are transferred in vCalendar formats. Ring melodies are transferred in eMelody format. For details on the supported vFormats, see [R520].

2.8 Synchronization

The phone can synchronise its contacts and calendar databases with e.g. the corresponding Outlook databases on a computer in case this has a synchronisation engine installed and is paired to the phone. (For details on the supported vFormats, see [R520].)

The phone is ready for PC initiated synchronisation when the operational mode is set to ON.

The user can initiate synchronisation from the phone by selecting Extras/Synchronisation/Synchronise/Use Bluetooth. Then user selects one of the PCs that are paired to the phone. Phone connects to the selected PC and requests the PC to initiate synchronisation.

3 Use Cases

3.1 Pairing

Based on Bonding as defined in [GAP].

3.1.1 Initiate Pairing (from the phone)

- 1 User ensures that the device to pair the phone with is set into pairable mode and has a passkey defined.
- 2 User initiates pairing (Paired devices/Add new/Phone initiates).
- 3 User selects what device type to pair with (headset, computer or all types).
- 4 Phone starts device discovery.
- 5 User selects the device to pair with in the list of discovered devices.
- 6 User enters the passkey of the device to pair with.
- 7 Phone pairs with the selected device.
- 8 User assigns a personal name tag and a new entry is created in the list of paired devices.

3.1.2 Accept Pairing (initiate pairing from the other device)

Generic description

- 1 User selects Paired devices/Add new/Phone accepts.
- 2 Phone is discoverable and pairable for 3 minutes.
- 3 User initiates pairing on the other device which starts device discovery.
- 4 User selects the phone in a list of discovered devices and enters the passkey on the other device.
- 5 Phone asks user to confirm pairing with the other device.
- 6 Phone asks user to enter the passkey.
- 7 Phone pairs with the other device.
- 8 User assigns a personal name tag to and a new entry is created in the list of paired devices.

Connect from PC

- 1 User selects Discoverable on the phone.
- 2 PC discovers the phone and displays its services.
- 3 User selects a service and decides to connect to the phone.
- 4 PC connects to the phone, asks user for a passkey and initiates pairing (if not already paired).
- 5 Phone asks user to confirm pairing with the other device.
- 6 Phone asks user to enter the passkey.
- 7 Phone pairs with the other device.
- 8 User assigns a personal name tag to and a new entry is created in the list of paired devices in the phone.

3.2 Discovery

As defined in [GAP].

3.2.1 Initiate Device Discovery:

- 1 User selects Discover.
- 2 Phone starts device discovery.
- 3 User is presented a list of discovered devices.
- 4 User selects one entry in the list and selects either Add to paired devices or Send my own.

3.2.2 Discoverable

- 1 User selects Discoverable.
- 2 Phone indicates to the user that it is now made discoverable for 3 minutes.
- 3 After 3 minutes, user is asked if to remain discoverable.
- 4 If user does not accept to remain discoverable, the operational mode is changed to ON or Auto.

3.3 Information Exchange

Based on [OPP].

3.3.1 Exchange Business Cards

- 1 The phone user agrees with another user of a phone or PDA to exchange their business cards. The other user sets his device into discoverable mode.
 - 2 User selects **Send my own** (after Phonebook/Business cards).
 - 3 User selects the option **Send via Bluetooth**.
 - 4 User is asked if to send to <name of last receiver> or to **Other** (i.e. if to discover a new receiver).
 - 5 If **Other** is chosen, phone starts device discovery (else goto 7).
 - 6 User selects one discovered device.
 - 7 Phone connects to the selected device and transfers the own business card.
- or

- 1 The phone user agrees with another user of a phone or PDA to exchange their business cards. The other user sets his device into discoverable mode.
- 2 User selects **Discover**.
- 3 Phone starts device discovery.
- 4 User is presented a list of discovered devices.
- 5 User selects one entry in the list.
- 6 Phone connects to the selected device and transfers the own business card.

3.3.2 Receive Object

- 1 The phone user agrees to receive an information object from another user of another phone or PDA.
- 2 User selects **Discoverable** or **Phone book/Business cards/Receive contact** or **Calendar/Receive**.
- 3 User of another device discovers the phone and initiates transfer of an object.
- 4 Phone receives the objects and if it is supported, the user is asked if to save it in the corresponding application database.
- 5 If the received object was a vCard, user is asked if to **Reply with own**. If accepted and user selects **Send via Bluetooth**, user is asked if to send to <name of sender> or to **Other** (i.e. if to discover new receiver).

3.3.3 Send Object

- 1 The phone user agrees to send an information object to another user of another phone or PDA that sets his devices into discoverable mode.
- 2 User selects an object in a phone application.
- 3 User selects the option **Send via Bluetooth**.
- 4 User is asked if to send to <name of last receiver> or to **Other** (i.e. if to discover new receiver).
- 5 If **Other** is chosen, phone starts device discovery (else goto 7).
- 6 User selects one discovered device.
- 7 Phone connects to the selected device and transfers the selected object.

3.3.4 Print Object

Printing is so far based on sending objects that the printer need to process.

- 1 User approaches a printer and ensures that it is in discoverable mode.
- 2 User selects an object in a phone application.
- 3 User selects the option **Send via Bluetooth**.
- 4 User is asked if to send to <name of last receiver> or to **Other** (i.e. if to discover new receiver).
- 5 If **Other** is chosen, phone starts device discovery (else goto 7).
- 6 User selects one discovered printer.
- 7 Phone connects to the printer and transfers the selected object.

3.4 Headset

To function, the headset has first to be paired with the phone. Phone supports pairing with only one single headset.

Based on [HSP].

More use cases are supported than those listed below.

3.4.1 Incoming Call

- 1 When phone receives an incoming GSM call, it connects to the headset (if in range).
- 2 When user presses the headset button, the call is answered and the call is connected to the headset.
- 3 When user presses the headset button again during the call, the call is hung-up and the headset is disconnected.

3.4.2 Outgoing Call

- 1 When user presses the headset button, the headset connects to the phone and opens an audio channel to the voice control function.
- 2 User initiates an outgoing call though voice dialling and the call is connected to the headset.
- 3 When user presses the headset button again during the call, the call is hung-up and the headset is disconnected.

3.4.3 Audio Transfer

From headset to phone

- 1 A call is ongoing in the headset.
- 2 User selects Transfer to phone in the ongoing calls menu.
- 3 Phone retrieves the audio path from the headset.
- 4 User continues the call in the phone.

From phone to headset

- 1 A call is ongoing in the phone.
- 2 User presses the headset button.
- 3 The headset connects to the phone and indicates that the button was pressed.
- 4 Phone transfers the audio path to the headset.
- 5 User continues the call in the headset.

3.5 Computer

To function, the computer has first to be paired with the phone.

3.5.1 Phone Control

Based on [SPP]. For details on the supported AT commands, see [R520].

- 1 User pairs the PC with the phone.
- 2 User configures a phone control application in the PC to use the COM port corresponding to the phone.
- 3 When the user makes a phone control action, the PC connects to the phone and transfers the corresponding AT command.

3.5.2 Dial-up Networking

Based on [DUN].

- 1 User pairs the PC with the phone.
- 2 User configures a dial-up connection in the PC to use the COM port corresponding to the paired Bluetooth device identified as a modem.
- 3 When the user initiates a dial-up session from the dial-up connections, the PC connects to the phone and transfers the dial command.

3.5.3 Synchronization

Based on [SP].

Initiated from phone

- 1 User pairs a PC with the phone.
- 2 User installs the synchronisation engine on the PC and configures it for usage with the phone.
- 3 User selects Synchronise/Use Bluetooth on the phone.
- 4 User selects one of the PCs that are paired to the phone.
- 5 Phone connects to the selected PC and transfers a start request.
- 6 PC connects to the phone and initiates the synchronisation process.

Initiated from PC

- 1 User pairs a PC with the phone.
- 2 User installs the synchronisation engine on the PC and configures it to synchronise automatically with the phone.
- 3 PC tries to connect to the phone at regular intervals (e.g. one paging per minute).
- 4 Phone gets in range of the PC and responds to the page.
- 5 PC connects to the phone and initiates the synchronisation process.

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